see Exploration 1 p128

$A = \pi r^2$

$$\frac{\Delta A}{\Delta r} \approx \frac{dA}{dr} = 2\pi r$$

der. of A with respect to r

How fast area changes compared to how fast radius changes

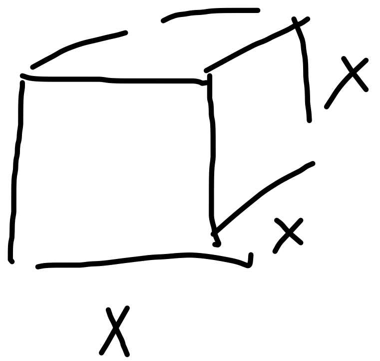
ΔA is constant, r gets bigger

$$\frac{\Delta A}{\cancel{\Delta r}} = 2\pi r \, \Delta r$$

radius

width of ring

The edges of a cube are growing at a rate of $.3 \frac{m}{s}$. How fast is volume changing when the edge is 4 m?



$V = x^3 = (.3t)^3$

t	x
0	0
1	.3
2	.6
3	.9

$x = .3t$

$4 = \cancel{.3}t$

$\frac{4}{.3}$

$V = .3^3 t^3$

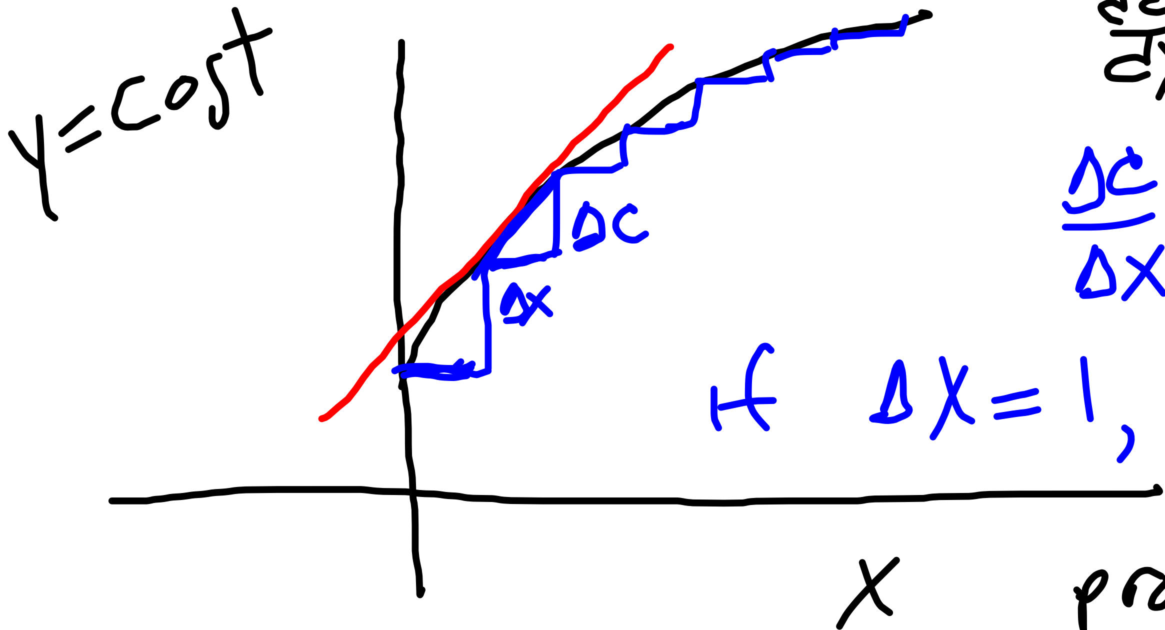
$$\frac{dv}{dt} = .3^3 \cdot 3t^2 \Big|_{t=\frac{4}{.3}}$$

der w.r.t. time

business derivative ~ marginal

marginal cost = der of cost

$\frac{dc}{dx}$ = slope of tan



$\frac{\Delta c}{\Delta x}$ = slope of secant

If $\Delta x = 1$, Δc = cost of producing the next one

production

$$\frac{\Delta c}{\Delta x} \approx \frac{dc}{dx}$$

$\frac{dy}{dx}$ approximates increase in y if x increases by 1

marginal cost $\approx$ cost of next item

marginal revenue $\approx$ revenue of next item

marginal profit $\approx$ profit next item

Profit $=$ Revenue $-$ Cost

Ex 7. $c(x) = x^3 - 6x^2 + 15x$

$r(x) = x^3 - 3x^2 + 12x$

find marginal cost, marginal revenue

$c'(x) = 3x^2 - 12x + 15$

$r'(x) = 3x^2 - 6x + 12$

$c'(10) = 195$ \$ - cost of 11^{th} radiator

$r'(10) = 252$ \$ - revenue for 11^{th} radiator

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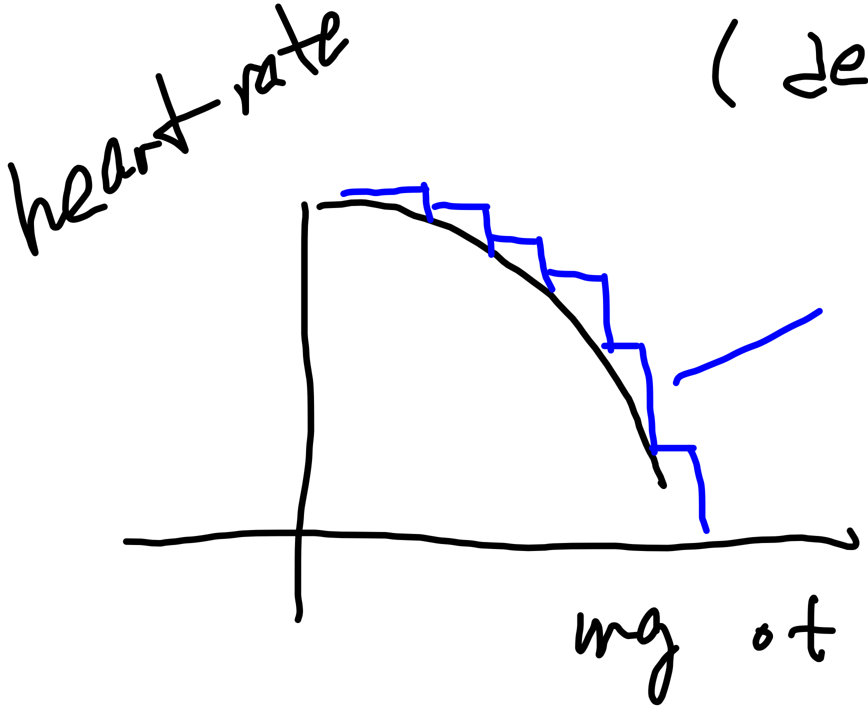
medicine

sensitivity to change (derivative)



vertical part ≈ derivative

$|\text{der}|$ is bigger $\Rightarrow$ more sensitive to change